MINUTES
MODEL-ASSISTED POD WORKING GROUP
NOVEMBER 16, 2007
LAS VEGAS, NEVADA

Attendees:

A list of attendees is attached as File 1.

Agenda:

The meeting agenda may be found in File 2.

Minutes:

INTRODUCTION

Lindgren welcomed the group and set the stage with the slides in File 3. Included was a statement of objectives, milestones, issues, introduction of a new SBIR program aimed at MAPOD and a definition of success. An ensuing discussion focused on the economic motivator for MAPOD. It was pointed out that, for flat plates, fabrication of each crack costs about $1K. Thus $60K would be the cost for samples alone if 60 cracks were to be examined. On top of this would be the costs of materials as well as significant increases in cost if more complex geometries were to be examined. In the case of some one-of-a-kind space structures, the costs of fabrication of a large sample set are orders of magnitude larger and out of the question.

STATUS OF DEMONSTRATION EFFORTS

This material was presented by Lindgren on behalf of Forsyth. Brief verbal summaries of a demonstration that had been done at AFRL by Knopp, Aldrin and Annis and of the intent of the upcoming SBIR call for UT MAPOD were first given.

This was followed by a more detailed discussion of current status of the AFRL program (Brausch) to quantify the relative responses of cracks and notches, as summarized in File 4. It was noted that automated scanning was being done with a pencil probe coupled to a Nortec 2000 instrument, that the cracks were grown in a way intended to produce relatively open cracks, and that it was the intent to do bending studies to produce closure. Goldfine commented that small cracks tend to have multiple branches, and in that limit, the simple crack vs notch studies break down. He also emphasized that it was important to specify the crack size range for which a study is intended. Hassan argued that, if the intent is to validate the MAPOD approach, the details of the selected problem are not too important. The primary purpose is to probe the capability of the models. He also advocated the use of CT to characterize the cracks.

Lindgren also summarized the status of the complex structure study, motivated by the C-130 Rainbow Fitting problem. Growing the cracks has been found to be a programmatic challenge, but some samples had come available. The discussion included the effects variability due to the sealant and other factors: what the variabilities are and how to treat them.

EDDY CURRENT MAPOD EFFORTS AT IOWA STATE

Thompson presented, on behalf of Nakagawa, an update of MAPOD EC efforts at Iowa State (File 5). This included work done under both FAA and AFRL support and included the industrial partners Cessna and Pratt and Whitney, respectively. The major items were the discussion of a model validation protocol, developed in collaboration with the OEM partners, and examples of its initial use in validation studies, with promising results.

REVIEW OF BRAUSCH VARIABILITY STUDIES

Lindgren reviewed the results of the Brausch Variability Studies, as documented in File 6, as had been presented earlier in the week at the ASNT conference. The results support the conclusion that human induced variance is the dominant factor in manual scan eddy current inspection performance variability. It was emphasized that all of the probes were balanced. The ensuing discussion included many anecdotal comments about cabling effects and master gauging and their importance. Lindgren emphasized that a major outcome of this study was to establish what variabilities do *not* have to be worried about. Thompson related this to MAPOD by stating that the big issue is the robustness of modeled predictions of the outcome of a calibrated experiment.

UPDATE ON INTERNATIONAL EFFORTS

Mandache (National Research Council, Canada) presented a summary of a Generic Bolt Hole Eddy Current Testing POD Study. Included was a discussion of a designed experiment and a numerical POD study. Details may be found in File 7. In the summary, it was noted that numerical modeling provided insight into inspectability/detectability factors and could be used in inspection optimization and interpretation of results. It was concluded that the numerical modeling serves as a cost-reduction tool for extensive POD studies, thereby allowing POD studies to be based on a limited number of inspections and creating portability of known POD results to similar inspection situations. Final results are scheduled to be presented at ASIP 2007.

Lindgren presented a summary of the DSTO work in Australia (Harding and Hugo) based on the information in File 8 that they had provided. Included was a request for simulated data sets for a benchmarking exercise.

File 9 contains a brief summary of the UK effort (Robert Smith, Qinetiq as presented by Thompson) on POD in cold worked holes. The program supporting the MAPOD efforts

had changed directions do to a decision to repair or replace wings so the MAPOD effort, in its initial form was abandoned. However, tear down of a fatigue test wing is expected to provide additional information such as comparison of tear down POD (real cracks in real structure) with POD based on EDM notches with a mark-up for closure. This was offered for presentation at the next meeting.

STATUS OF TOTEM POLE ISSUES

Forsyth summarized the status of the Totem Pole issues. File 10 shows the initial list of items to be addressed and the individuals who had agreed to work these issues. File 11 summarizes current status. In the latter context, there was a discussion of the need to consider false call rates. It was suggested that the current status of the totem pole issues be distributed to the MAPOD membership to determine if there was a consensus on this evaluation. It was also suggested that a gap analysis be conducted.

STATUS OF UPDATE OF 1823

Lindgren summarized the status of the update of 1823, which is in the middle of the review cycle.

STATISTICAL APPROACHES

This session was designed to discuss a number of advanced topics associated with the determination of POD as listed in File 12. Thompson made short presentation regarding the first and the third, both developed in collaboration with Meeker. File 13 outlines the steps needed to validate a new POD approach. File 14 presents a discussion of how to extend the concept of confidence bounds to model-based data. Lindgren led a discussion of issues associated with determining the POD of SHM. This was a broad ranging discussion and sequel discussions will be required before a well defined procedure will emerge. Among the issues is the fact that there are many classes of strategies for SHM, and each might require a different way to determine the POD. Discussion of the remaining advanced topics was deferred to another meeting.

Next Meeting:

There was an extended discussion regarding whether to hold future meetings at 6 month or 12 month intervals. Thompson agreed to poll the total membership of the MAPOD Working Group. The time and place of the next meeting will be determined on the basis that poll and announced to the group by email as well as being placed on the MAPOD web site.